Alternative Approach of Inventive Problem Solving for Digital Right Management Technology Innovation

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Abstract—Digital Right Management (DRM) is considered as the target of applying the innovation tools for technology enhancement because DRM is one of most critical features in the mobile industries. DRM is the access control technology to be used by issuers and other copyright holders to limit usage of digital media or devices. Event driven Digital Right Management is the new DRM technology that has been designed by using TRIZ method. TRIZ (Teoriya Resheniya Izobretatelskikh Zadatch) that is also called TIPS (Theory of Inventive Problem Solving) is a methodology and model-based technology for generating innovative ideas and solutions for problem solving. Unlike general right objects, event driven DRM controls the right object based on events. Practical TRIZ approaches are demonstrated that can be applied for other technology innovation problems.

Index Terms—Innovation, DRM, Event driven DRM, TRIZ, TIPS

I. INTRODUCTION

TRIZ (Teoriya Resheniya Izobretatelskikh Zadatch) that is also called TIPS (Theory of Inventive Problem Solving) is a methodology and model-based technology for generating innovative ideas and solutions for problem solving [1]. It has been developed by Genrich Saulovich Altshuller who has believed that learning how to invent is feasible [1-3].



Fig. 1. Digital Right Management Architecture

After his first approach, TRIZ has been evolved as the science of invention and many companies are adopting TRIZ

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to solve complex technical problems. Digital rights management (DRM) is an access control method used by right issuers and other copyright holders to limit usage of digital media or devices with various constraints [4]. It is also known as restrictions associated with specific instances of digital media. The role of Digital Right Management in the view point of protected contents is for enabling business models whereby the consumption and use of content is controlled. For instant, DRM extends beyond the physical delivery of content into managing the content lifecycle. Right Object (RO) is one of key elements for DRM architecture and it is designed for specified consumption rules of DRM protected contents. The Rights Expression Language (REL) defined by Open Mobile Alliance DRM (aka. OMA DRM) specifies the syntax by using Extensible Markup Language (XML) and semantics of permissions and constraints governing of protected contents [4, 5]. Rights Objects are made up of constraints that along with other information embodied may be presented to the user. Rights Objects may also include constraints that require a certain user to be present when the content is used. The RO also governs access to DRM contents by including the content encryption key [4].

Event driven Digital Right Management [6, 7] is the new DRM technology that has been designed by using the innovative method for problem solving. Unlike general right objects, event driven DRM controls the right object based on events. TRIZ methodology is applied for mobile technology enhancement in this paper. Event driven DRM RO has been invented by using TRIZ. The tactical solution of TRIZ application is also introduced to demonstrate the guidelines for applying other industries.

II. TRIZ METHODOLOGY

2.1. Technical Contradiction

TRIZ defines a set of 40 inventive principles and 39 system features that one typically wants to improve. The system that has the technical contradiction can be clarified based on the feature for improve and the feature for remove within a set of system features [3]. Originally, Altshuller reviewed patents in order to find out what kind of contradictions were resolved or dissolved by benchmark the patents that had been achieved.

The constraints for Right Objects in the current OMA standard are either fixed period of time and attempting of execution. But a user can exit the protected contents at any times. This behavior of user is called event and event driven DRM RO is designed for control the random event. The technical contradictions (TC) are:

TC 1: If RO expire is requested by RI directly, then good for control, but bad for having the risks of hacking and traffic increase

TC 2: If RO expire is NOT requested directly, then good for reduce the traffic and hacking risk

and TC 2 is taken to design the event driven DRM RO (see Figure 2). Idle Final Result (IFR) can be defined as good for RO control and reduce hacking risk and traffic without any additional harmful effects.



Fig. 2. Idle Final Result of Technical Contradiction 2

Based on the above conditions, Invention principle 1 (Segmentation) and Invention principle 10 (Preliminary action) are applied to solve the technical contradiction.

2.2. Idle Approach

Idle approach means that the status of the element approaches the extreme case. It is one of typical TRIZ procedure for out-of-box thinking. The contraction can be intensified. Event driven DRM RO must be provided by Right Issuer over the air. But it is required reliable and secure network infrastructure and it occur the additional network traffic. In addition, DRM RO is not issued if Right Issuer is not available. The extreme case is considered to solve the contradiction. Unlike the Su-Field model approach, one of elements is removed to solve the problem. The additional resources may be added.



Fig. 3. Intensification of Contradiction

Based on intensifying the contraction, Pre-configured DRM RO is proposed. The detailed process is explained in the further section.

2.3. Substance-Field Model

There is another TRIZ approach to solve the limitation of Right Object constraints. Substance-Field (Su-Field) model is for analyze the problems related existing technological systems [8]. Su-Field model analysis is applied for making innovative problems to the form of analysis model related to the current technical system. It means that Su-Field model is the tool for identifying problems in a technical system and finding innovative solutions to these identified problems [9]. Genrich Altshuller and his colleagues identified 76 standard solutions to fixing problematic Su-Field models based on their intensive research of a huge number of patents [2, 8, 9]. Based on Su-Field model, standard solution 1-2-2 (Modification) is suitable to remove the risk of Right Object expire complexity (see Figure 4)



Fig. 4. Su-Field Model for Event Drive DRM RO

III. EVENT DRIVEN DRM TECHNOLOGY INNOVATION

There are two types of event driven DRM Right Object to be shown. One is standalone type and the other is network based type. Pre-configured event driven DRM RO is standalone type technology without using any networks for sending Temp_RO. Idle Approach method from section 3 is applied to design the DRM RO. In the other hand, Event driven DRM RO over the air is network based type and Right Issuer is using the network for sending Temp_RO to guest users. Su-Field Model from section 4 and 40 Principle method from section 2 is applied for network based event driven DRM RO. The event driven DRM Right Object defines the constraints that are directly applicable for random events such as local network games, on-line chatting, live concerts and so on. It makes more flexible control of Right Object during the SD (Separate Delivery) process.

3.1.Pre-configured DRM RO: Idle Approach

The temporary Right Object (Temp_RO) is expire whenever an event is completed [2]. Right Issuer (RI) is not needed because information for authentication is pre-configured. Pre-configured DRM RO is technically the idle solution but it may not be the best solution in the real world application. The service providers can not generate the revenue based on data traffic because Pre-configure DRM RO does not need Right Issuer and not have additional data traffic for Right Object control. But service providers are still gathering the revenue based on DRM protected contents (See the Figure 5.)

3.2. Event Driven DRM RO: Su-Field Model

There is the practical method in the view point of mobile business. The network based DRM RO can be considered with samely manner. Most of workflow is same as Pre-configured DRM RO but there is interworking with networks additionally. It may not be technically idle solution but can generate the revenue based on additional data traffic for license (See the Figure 5.) Both of event driven DRM RO methods gain the optimum revenues from not only contents based charging but also event based charging.





Controlling the DRM Right Object is one of key factors for generating revenue based on DRM protected contents. The event driven DRM RO offers the controlling not only the contents but also virtual room without additional infrastructure costs. This section gives the several use cases and typical scenarios for each use case to show the usage of the event driven DRM RO in the real life.

The setups for use cases contain the three actors. Master user is the owner who has the right to operate contents or local chatting room and Guest users are the users who are joining the event or local chatting room. Right Issuer (RI) is the agent who provides the DRM Right Objects. Temp_RO is the special type of RO that is expired when the master user closed the event.

One of practical use case is the private chatting room that is operated by Master user within local connection. The revenue will be generated even though the server for chatting is not provided by the service providers. A typical scenario may go the following steps: (1) Master user invite the guest users whom like to join the chat. (2) Guest users who are invited accept their invitation. (3) RI distributes the Temp_RO to the guest users who invited by the master user. (4) Guest users are joining the chatting and keeping their RO regardless of connection status until Temp_RO is expired. (5) Temp_ROs are expired when the master user closed his chatting room.



Figure 6. Workflow of Event Driven DRM RO Process

Another practical use case is the local network based game. For instant, people want to have network game locally such as StarCraft in PC within close location such as same class room, same building and so on. Master user can generate a virtual game space for playing online game locally. The service provider can generate the revenue only for offering the virtual game room without providing servers. The procedure of the event driven DRM operations are almost same as chatting room use case except for the matter of "Event." Temp_ROs are expired when the master user closes his game space instead of the chatting room in this case. The event driven DRM RO can be applied for the live broadcasting as another use case. Unlike typical broadcasting, the running time for live show is not fixed but the event driven right object can expired whenever live show is ended.

V. PERFORMANCE COMPARISON WITH EXISTING DRM TECHNOLOGY

Three DRM right object methods are considered for simulation. One is the event driven right object management method that is proposed in this paper. DRM contents are changed based on the token that is clarified in the RO. The others are the right object management scheme that is applied in the current Open Mobile Alliance standards [6, 7] with two different RO expire mechanisms. All of tokens in RO are activated when the DRM applications (or contents) are activated but the moments of expiration are different. The regular RO that is currently available in the standard is expired based on the fixed time. It means that RO is expired regardless of the actual moment of contents determinations. There are the cost losses if the moments between DRM contents determination and RO expiration are not matched. Service providers do not want to give the extra permissions to users after contents services are completed.

In the other hand, a user expects that the token should be active at least during the contents execution and it comes to service providers as cost loss. The optimal case to remove the cost loss is that both moments are happened at the same time. Since the user execution of DRM contents is stochastically independent, Poisson process is considered for predict of RO expiration moment to remove the cost loss because the residual time in Poisson process has the memoryless property [10] that is similar with human behavior in online situations. This solution gives the better performance than regular RO method for reducing the cost but it is still remained loss. The optimal solution for cost loss reduction is Event Driven RO method because the moments between determination and RO expiration are matched. Since there is no cost loss, it gives full benefits to both a user and a provider. The fixed amount of token release is considered for simulation. The reward is based on number of taken release and there are no reward reductions in case of Event Driven RO method. The efficiency of the Event Driven RO solution can be solved as follows:

$$\varepsilon = \frac{\gamma_e - \gamma_r}{\gamma_r} \qquad (5.1)$$

where r_r is the reward of regular RO solution and is the reward of Even Driven RO solution. The comparison graph (see Figure 6) shows the efficiency of random RO is 0.6617 and the efficiency of Event Drive RO is 0.47. It means that Event Driven RO method earns about 47[%] more than regular RO methods.



Fig. 6. Simulation of comparison graph

VI. CONCLUSION

The major target of this project is developing the new DRM Right Object to control the events such as local network games, online chatting and so on. This new technology support more flexible business models because it can control not only DRM related contents but also user actions. Theory of Inventive Problem Solving (TRIZ) methodology makes possible to design the new types of Right Object. Even though the research is dedicated with mobile industries, the pattern of TRIZ approach in this paper can be also applied to other industries.

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